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H. W. WILEY, Chief of Bureau.

REPORT ON COLORS: THE SOLUBILITY AND EXTRACTION OF COLORS AND THE COLOR REACTIONS OF DYED FIBER AND OF AQUEOUS AND SULPHURIC-ACID SOLUTIONS.

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INTRODUCTION.

The subject of food colors is so extensive, and so little, comparatively, has been accomplished in the field, that the reports of the referees in charge of these investigations have been confined to preliminary or tentative work, such for example as that reported in Circular 25 of this Bureau, by Mr. W. G. Berry, under the title "Coloring Matters for Foodstuffs and Methods for their Detection." The present paper, submitted as a subreport at the 1906 convention of the Association of Official Agricultural Chemists, it is thought will be of considerable value, for reference, to those working along these lines, although the results are, of course, only approximate, and will doubtless be improved upon by further work.

Respectfully, H. W. Wiley,
Chief of Bureau,
Secretary, Association of Official Agricultural Chemists.

Approved:
James Wilson,
Secretary of Agriculture.

Washington, D. C., *January 10, 1907.*

PLAN OF THE EXPERIMENTS.

The tables given in this report show the result of experimental work done on various coloring matters. Most of the coal tar colors used were obtained direct from the manufacturers or agents, to whom grateful acknowledgment is due. The names of these firms and the

abbreviations under which they are designated in the descriptions of the colors in the tables are as follows:

H. A. Metz & Co., agents for Meister, Lucius & Brüning (M. L. B.).
Berlin Aniline Works (Berlin).
American Aniline and Extract Company, agents for Brooke, Simpson & Spiller, Ltd., London, E. (B. S. S.).
Continental Color and Chemical Company, agents for F. Bayer & Co. (By.) and Badische Anilin- und Soda-Fabrik (Bad.).
Cassella Color Company (Cassella).
Geisenheimer & Co., agents for K. Oehler (Oehler).
Read, Holliday & Sons (R. H.).
Schoellkopf, Hartford & Hanna Company (Sch.).
W. F. Sykes & Co., agents for St. Denis Dye Stuff and Chemical Company (St. Denis), and for Coez, Langlois & Company (Coez) or (Sykes).
Kalle & Co. (Kalle).
Eimer & Amend (E. & A.).
George Grübler & Co. (Grübler).

SOLUBILITY.

The results given for solubility in Table I are only approximate and were obtained by shaking an excess of the color with the various solvents named, filtering, if necessary, and evaporating to dryness, in order to determine the amount of color dissolved. The letters used to express the varying degrees of solubility are explained in connection with the table. Where the color of the solution is not given it may be assumed to be practically the same as that of the aqueous solution.

The numbers in the last column of Table I are those of the corresponding colors in Green's translation of the fourth German edition of "A Systematic Survey of the Organic Coloring Matters," by Schultz and Julius.

EXTRACTION WITH IMMISCIBLE SOLVENTS.

The determinations given in Table II were made as follows:

Twenty-five cubic centimeters of a 0.01 per cent solution of coal tar color, or about a 0.10 per cent solution of natural coloring matters, were well shaken up with 25 cc of the immiscible solvent in a separating funnel. In the case of extraction with acetone the solution of color was first saturated with common salt to render the acetone insoluble. After separation into layers, the amount of color extracted was determined either by the relative depth of color in the two layers or by taking equal volumes of each layer and ascertaining the proportions by dyeing tests on plain or mordanted wool. The signs 0, $>\frac{1}{2}$ (more than half), and $<\frac{1}{2}$ (less than half) indicate the amount of color extracted from the aqueous solution. The color given underneath the above signs indicates the color of the immiscible solvent solution, unless otherwise specified. From 5 to 10 drops of concentrated hydrochloric acid or ammonium hydroxid (0.95 sp. gr.) were used to make the solutions acid or alkaline.

COLOR REACTIONS OF DYED FIBER.

In the tests reported in Table III the wool was dyed with one-half per cent of coal tar color in every case; in the case of natural coloring matters the amount used was about ten times greater. A piece of dyed zephyr yarn about 1 inch long was covered with 2 or 3 cc of the reagent in a small porcelain dish. Unless the color of the reagent became marked nothing is noted in the column marked "solution" in the table. The color reactions were observed three or four minutes after the addition of the reagent. The dyed fiber should be dry in making these tests to prevent charring of the fiber by the strong acids.

REACTION OF COLORS IN AQUEOUS SOLUTION AND WITH CONCENTRATED SULPHURIC ACID.

While similar tables have been prepared by other workers, considerable uncertainty arises in using them, and it has been the aim of the writer in preparing these tables to be somewhat more precise in the description of these reactions. As one means to this end, in Table IV the approximate strength of the color solution used (about 0.01 per cent) is indicated by the color of the solution in a test tube three-quarters of an inch in diameter. As before stated, the solutions of natural coloring matter are about ten times stronger than those of the coal-tar dyes, namely, 0.1 and 0.01 per cent, respectively. About 5 cc of color solution, 0.2 gram of zinc dust, and 10 drops of concentrated hydrochloric acid were used for the reduction test, and approximately 10 cc of color solution for the other reactions in aqueous solution.

The dry color test with concentrated sulphuric acid was conducted as follows:

About 0.01 gram of coal tar color, or 0.05 gram of natural coloring matter, was dissolved by shaking with 5 cc of concentrated sulphuric acid in a test tube. The solution was diluted with water, 3 to 5 cc at a time, until the volume reached about 20 cc, then more rapidly with constant shaking, noting any changes in the appearance of the solution, until such change seemed merely to affect the depth of the color.

TABLE I.—SOLUBILITY OF COLORS, WITH COLOR OF SOLUTION.

[S = readily soluble; s = fairly soluble; F = slightly soluble; f = almost insoluble; I = insoluble.]

COAL TAR COLORS.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Ponceau red (Grübler).	S Crimson.	F Orange.	S Orange.	I	f	I	F	S Red orange	.....	.....
Ponceau 6 R (M. L. B.).	S Crimson.	I	S Deep cherry.	I	I	I	I	I	.....	108
Benzopurpurin (Grübler).	s Cherry red.	S Cherry.	S	I	f Orange.	F	f	I	.....	277 or 278
New coccin (Berlin).	S Orange red.	F Cherry.	S Cherry.	I	f Orange.	I	I	f	.....	106
Bordeaux B (Berlin).	S Crimson.	s Crimson.	S	I	I	I	F	S	.....	65
Ponceau 4 RB (Berlin).	S Crimson.	S	S	I	f Pink.	F	F	S	.....	160
Fuchsin.	S Crimson.	S	S	F Lilac.	s Crimson.	s	S	S	.....	448
Congo red (Grübler).	S Cherry red.	s	S Deep orange.	I	I	I	I	I	.....	240
Eosin (Grübler).	S Cherry red; fluor.	S Red orange; strong fluor.	S Red orange; strong fluor.	I	F Red orange; fluor.	F Red orange; fluor.	S Red orange; fluor.	S Yellow.	.....	512

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Scarlet 6 R (M. L. B.).	S Cherry red.	I	S Crimson.	I	I	I	I	I	.....	108
Safranin (B. S. S.).	S Crimson.	S Cherry; fluor.	S Cherry; slight fluor.	I	F	F Cherry; fluor.	S Cherry; fluor.	S	.....	584
Crocein scarlet 3 B (By.).	S Cherry.	S	S Red orange.	I	I	F	F	s Red orange; ppt.	.....	160
Crocein scarlet 7 B (By.).	S Crimson.	S	S Deep cherry.	I	I	F	F Magenta.	s Orange red.	.....	169
Azo-eosin (By.).	S Scarlet.	S Orange red.	S Orange red.	I	F Orange red.	f Scarlet.	S Orange red; green fluor.	F Orange red.	.....	71
Acid magenta (Bad.).	S Deep crimson.	S	S	I	I	F Violet.	f Pale magenta.	f Pale magenta.	.....	462
Eosin A (Bad.).	S Orange red; green fluor.	S Orange; green fluor.	S Orange; green fluor.	I	F Pink; green fluor.	F Green fluor.	S Green fluor.	S Orange.	.....	512
Fast ponceau B (Bad.).	S Orange red.	s Red orange.	S	I	I	F Red orange	F Pale magenta.	F Brown.	.....	163

TABLE 1.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Rose bengal (Bad.).	S Orange red.	S Light crimson.	S Light crimson.	f Pink.	s Light crimson; yellow fluor.	s Light crimson; yellow fluor.	S Crimson.	s Orange.	.....	520 and 523
Cochineal red A (Bad.).	S Orange red.	s	S Cherry red.	I	f Reddish.	F	f Pink.	F Orange red.	.....	106
Fast red A (Bad.).	S Orange red.	S	S	I	s	s	S	S Crimson.	.....	102
Fast red B (Bad.).	S Deep crimson.	S Deep orange red.	S Crimson.	I	f Orange.	s Orange red.	f Pink.	S Crimson.	.....	65
Fast red C (Bad.).	S Crimson.	S Orange red.	S Orange red.	I	f Pink.	f Orange red.	F Magenta.	s Crimson.	.....	103
Fast red D (Bad.).	S Crimson.	S	S	I	s Orange red.	s Orange red.	s Orange red.	S Crimson.	.....	107
Phloxin (Bad.).	S Orange; green fluor.	S Orange red; yellow fluor.	S Orange; green fluor.	f Pink.	S Pink; yellow fluor.	S Yellow fluor.	S Pink; yellow fluor.	S Orange.	.....	521
Rhodamin (Bad.).	S Light crimson.	S Deep pink; yellow fluor.	S Deep pink; yellow fluor.	F Light magenta.	S Slight fluor.	S Yellow fluor.	S Yellow fluor.	S Deep pink; yellow fluor.	.....	504

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Metanil yellow (Oehler).	S Orange.	S Yellow.	S Orange	F Yellow.	S	F Yellow.	S Yellow.	S Orange brown.	.....	95
Amaranth B (Cassella).	S Deep crimson.	f Pink.	f Wine color.	I	I	I	I	f Orange brown.	.....	.....
Lanafuchsin 6 B (Cassella).	S Deep crimson.	S	S	I	I	F	F Purple.	S	.....	.....
Brilliant cochineal 2 R (Cassella).	S Orange red.	S	S	I	I	f Orange.	F	S	.....	53
Chrysoïdin (Grübler).	S Orange red.	S	S	f Yellow.	s	F Orange brown.	S	S	.....	.....
Tropæolin OO (Cassella).	S Orange.	S	S	I	F	f Orange yellow.	F	S Wine red.	.....	88
Naphthol yellow (Grübler).	F Yellow.	S	S	s or F Yellow.	S	S	S	s	.....	.....
Methyl orange (Grübler).	S Orange.	S	S	I	F	F Yellow.	F	f Light brown.	.....	87
Naphthol yellow (Bad.).	S Yellow.	F	S	I	f	F	f	f	.....	4

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Tartrazin (Bad.).	S Yellow.	F	F	I	I	I	I	f	.....	94
Fast yellow (Bad.)	S Orange yellow.	F Yellow.	S	f	F	f Yellow.	f Yellow.	F Orange red.	.....	8
Orange II (By.).	S Red orange.	F	S	I	f	f Orange.	F	F	.....	86
Crocein orange G (By.).	S Orange.	S	S	f	F	F	F	F	.....	13
Ponceau 4 GB (Berlin).	S Orange red.	S Orange yellow.	F Orange yellow.	I	F Orange.	F	f Orange yellow.	s	.....	13
Orange G (Berlin).	S Orange.	F Orange yellow.	F	I	I	f	I	S	.....	14
Orange G (R. H.).	S Red orange.	s Orange red.	s	I	f Orange.	F	F	s	.....	14
Orange extra (Cassella).	S Red orange.	s Orange red.	F	I	f Orange.	F	F	s	.....	86
Orange GG crystals (Cassella).	S Orange.	F	S	I	f Yellow.	f	I	S	.....	14

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Tropæolin O (Cassella).	S Orange.	F	F	I	f Yellow.	F	F	s	.....	84
Azo blue (By.).	S Deep violet.	F Magenta.	F Crimson.	I	f Pink.	F Crimson.	f	F Magenta.	.....	287
Cyanole FF (Cassella).	S Deep purple.	S	S	I	f Blue.	F	F Blue.	S	.....	439
Malachite green (Berlin).	S Greenish blue.	S	S	f Pale blue.	s	S	F Bluish green.	S	.....	427
Ethyl green (Berlin).	S Bluish green.	S	S	I	F	S	F Bluish green.	S	.....	.....
Acid green 780 (Cassella).	S Green.	S	S	I	I	f	F	F	.....	435
Cyanole green 6 G (Cassella).	S Bluish green.	S Blue.	S Blue.	I	f	S	S Blue.	S	.....	.....
Naphthol green B (Cassella).	S Green.	f	S	I	I	I	I	I	.....	398
Methylene blue (Bad.).	S Deep blue.	S	S	I	f	F	F	S	.....	650

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Tetracyanole SF (Cassella).	S Blue.	S	S	I	F	F	F	S	.....	440
Methylene violet 2 BX (Berlin).	S Deep violet.	S	S	f Violet.	s	S	S	S	.....	585
Bismarck brown extra (Berlin).	S Orange brown.	S	S	I	F Brown.	f Yellow.	F Brown.	f Brown yellow.	.....	197
Fast brown G (Berlin).	S Crimson.	S	S	I	F Orange brown.	f	I	F	.....	138
Naphthol black BDF (Cassella).	S Violet blue.	I	S	i	I	I	I	I	.....	188
Chocolate brown 694—mixture (Sch.).	S Dark brown.	S	S	I	F Orange.	F Orange.	I	s Orange.	.....	.....
Soudan I (Berlin).	I	S Brown.	S	S Red brown.	S	S	S Yellow brown.	S Red brown.	.....	11
Soudan II (Berlin).	I	S Brown.	S	S Red brown.	S	S	S Yellow brown.	S Red brown.	.....	49

TABLE 1.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Soudan G (Berlin).	I	S Brown.	S	S Red brown.	S	S	S Yellow brown.	S Red brown.	.....	10
Wool yellow T extra (Sch.).	S Yellow.	F	s	I	I	I	I	f	.....	94
Brilliant yellow S (Sch.).	S Brown.	f Yellow.	S Brown.	I	I	I	I	F Yellow.	.....	.....
Croceïn orange Y (Sch.).	S Orange.	F	S	I	f	F	F	F	.....	43
Brilliant pink—mixture (Sch.).	S Cherry red.	F	S	I	F	I	I	F Orange red.	.....	.....
Azo-rubin (Sch.).	S Crimson.	F	s	I	I	f Pale magenta.	f Pale magenta.	F Cherry.	.....	103
Amaranth (Sch.)	S Crimson.	I	S	I	I	I	I	f Pink.	.....	107
Fast pink B (Sch.).	S Cherry red, yellow fluor.	S Yellow fluor.	S Fluor.	F Fluor.	S Fluor.	s Fluor.	S Fluor.	S Fluor.	.....	504
Ponceau 2 R (Sch.).	S Cherry red.	F	S	I	I	I	I	F Orange red.	.....	56

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Ponceau 3 R (Sch.).	S Cherry red.	F	S	I	I	I	I	F	.....	55
Sausage color—mixture (Sch.)	S Crimson.	F	s	I	I	f	f Pink.	F Orange red.	.....	.....
Acid green OO (Sch.).	S Blue green.	s	S	I	I	I	I	F	.....	435
Pistachio green 810—mixture (Sch.).	S Green.	S	S	I	I	I	I	S	.....	.....
Methyl-violet DB (Sch.).	S Violet.	S	S	F Violet.	S	S	S	S	.....	451
Pink M (R. H.).	S Light crimson; fluor.	S	S	F Pale magenta.	S Cherry; fluor.	S Cherry; fluor.	S Cherry; fluor.	S Cherry; fluor.	.....	504
Scarlet RD (R. H.).	S Orange red.	s	S	I	F	F	F	S	.....	54
Archil substitute (R. H.).	f Red orange.	s	s Crimson.	I	F	F Crimson.	F	s	.....	28
Carmosin B (R. H.).	S Crimson.	F	S	I	f Red orange.	F Brown orange.	F	F	.....	103

TABLE 1.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Orange IV (R. H.).	F Orange.	S	S	f Yellow.	s Orange yellow.	F	s	F Orange brown.	.....	88
Tyemond orange (R. H.).	S Orange brown.	F Orange.	S Red.	I	f	F Orange.	f Orange.	s Red orange.	.....	.....
Yellow YM (R. H.).	S Orange.	F Yellow.	S	f	f	F	f	s Yellow.	.....	4
"Chinolin yellow" (R.H.).[a]	S Yellow.	F Yellow.	S	I	F	F	F	F	.....	667(?)
Orange II (St. Denis).	S Orange red.	s Orange.	S Orange.	I	F Orange.	F Orange.	F Orange.	s Orange.	.....	86(?)
Biebrich fast scarlet O (Kalle).	S Orange red.	F Orange.	S Scarlet.	I	F Orange.	f Pink.	f Pink.	s Wine red.	.....	175
Biebrich croceïn scarlet O (Kalle).	s Orange red.	F Orange red.	S Scarlet.	I	f Orange.	f Orange.	f Pink.	F Crimson.	.....	176
Biebrich croceïn scarlet OO (Kalle).	S Scarlet.	F Scarlet.	F Scarlet.	I	f Orange.	F Orange.	f Pink.	F Crimson.	.....	185

[a] Manufacturer's term; undoubtedly same as "quinolin."

TABLE I.—*Solubility of colors, with color of solution*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Biebrich brilliant crocein scarlet O (Kalle).	S Scarlet.	F Orange red.	S Scarlet.	I	f Orange.	f Orange.	f Orange.	F Scarlet.	.....	162
Biebrich brilliant crocein scarlet ON (Kalle).	s Scarlet.	F Orange red.	s Scarlet.	I	f Orange.	f Orange.	f Orange.	F Scarlet.	.....	162
Archil substitute 3 VN (St. Denis).	S Magenta.	s Crimson.	S Crimson.	F Orange red.	F Crimson.	S Crimson.	F Crimson.	F Wine red.	.....	29

NATURAL COLORS.

Cochineal.	S Wine red.	S	F	I	I	I	I	S Orange.	S Purple.	.....
Cudbear (E. & A.).	F Violet red.	F Crimson.	S Crimson.	f	s Crimson.	F Crimson.	F Crimson.	S Crimson.	S Purple.	.....
Archil (E. & A.).	s Wine red.	S	S Crimson.	I	F	F	F	F Red.	S Crimson.	.....
Litmus cubes.	S Blue.	I	I	I	I	I	I	I	S Blue	.....
Azo-litmin (Merck).	S Magenta.	I	I	I	I	I	I	F Orange red.	S Blue.	.....

TABLE I.—*Solubility of colors, with color of solution*—Continued.

NATURAL COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Alcannin, oil soluble (German).	I	S Crimson.	S	S	S	S	S	S Orange red.	S Blue.	.....
Coloring matter, logwood (E. & A.).	F Brown.	S	S	F Orange.	S	S	S	S	S Red brown.	.....
Coloring matter, Brazil wood (E. & A.).	f Orange yellow.	s Orange.	S Orange brown.	F Yellow.	S Orange.	S Orange brown.	S Orange brown.	S Orange brown.	S Wine red.	.....
Coloring matter, barwood (E. & A.).	I	S Wine red.	S Wine red.	F Yellow.	S Orange brown.	S Orange brown.	S Wine red.	S Orange red.	S Maroon.	.....
Catechu (E. & A.).	f (s, hot water.)	I	F Orange yellow.	I	I	I	I	I	S Brown.	.....
Yellow color from American safflower.	S Yellow.	f Pale yellow.	F Yellow.	I	I	I	I	F	S Yellow brown.	.....
Spanish saffron (E. & A.).	S Orange.	F Yellow.	S Orange.	f	F	F	I	S	S	.....
Cape aloes (E. & A.).	S Yellow brown.	S Yellow brown.	S	F Yellow.	F Yellow.	S	F	S	S Orange brown.	.....

TABLE I.—*Solubility of colors, with color of solution*—Continued.

NATURAL COLORS—Continued.

Name of color.	Water.	Ethyl alcohol (90.5 per cent by weight).	Methyl alcohol (97 per cent by weight).	Ethyl ether, U. S. P.	Ethyl acetate.	Acetone.	Amyl alcohol.	Glacial acetic acid (99 per cent).	Ammonia water.	Schultz and Julius numbers.
Coloring matter, quercitron (E. & A.).	F Yellow.	s Yellow brown.	s Yellow brown.	f	F	s Yellow brown.	f	F	s Brown.	.....
Sumac powder (E. & A.).	S Yellow brown.	I	F	I	I	f	I	S	S Yellow brown.	.....
Annatto (E. & A.).	I	F Orange.	F	s	S	F	F	s	f Orange.	.....
Turmeric.	I	S Orange.	s	F	s	F	F	S	F Orange brown.	.....
Persian berry extract (Sykes).	S Yellow.	F Yellow.	F	I	I	I	f	F	S Red brown.	.....
Fustic extract excelsior (Sykes).	S Yellow brown.	S	s	S Yellow.	s	S	s	S	S Brown.	.....
Weld extract (Sykes).	F Yellow.	f Yellow.	F Yellow.	I	I	I	I	F Brown yellow.	S Yellow brown.	.....
Chlorophyl, fat soluble (Germany).	I	S	S	S	S	S	S	S Green.	S Green.	.....
Buckthorn berries (Germany E. & A.).	S Yellow brown.	F Yellow.	S Yellow brown.	I	f Yellow.	I	I	s	S Brown.	.....

TABLE II.—EXTRACTION OF COLORS WITH IMMISCIBLE SOLVENTS FROM AQUEOUS SOLUTIONS.

[Fraction indicates amount of color extracted by one treatment; P = color precipitated from solution by salt.]

COAL TAR COLORS.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Ponceau red (Grübler).	0	0	0	$<\frac{1}{9}$ Orange.	$<\frac{1}{9}$ Yellow pink.	$<\frac{1}{9}$ Orange.	P $<\frac{1}{9}$ Orange yellow.	$<\frac{1}{9}$ Orange.	$\frac{1}{9}$
Ponceau 6 R (M. L. B.).	0	0	0	0	0	0	0	0	0
Benzopurpurin (Grübler).	0	0	0	$<\frac{1}{9}$ Orange red.	$<\frac{1}{9}$ Orange red.	$<\frac{1}{9}$	Nearly all extracted.	Nearly all extracted.	Nearly all extracted.
New coccin (Berlin).	0	0	0	0	0	Nearly 0 Pink.	Nearly 0 Orange.	Nearly 0 Pink.	Nearly 0 Orange.
Bordeaux B (Berlin).	0	0	0	$<\frac{1}{9}$	$<\frac{1}{9}$	$<\frac{1}{9}$	$<\frac{1}{9}$	P $<\frac{1}{9}$	$\frac{1}{9}$
Ponceau 4 RB (Berlin).	0	0	0	$<\frac{1}{9}$	$<\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$
Fuchsin.	$<\frac{1}{9}$ Purple.	$\frac{1}{9}$	$<\frac{1}{9}$ Magenta.	$\frac{1}{9}$ Crimson.	All extracted.	All extracted.	$>\frac{1}{9}$ Crimson.	$>\frac{1}{9}$	$>\frac{1}{9}$
Eosin (Grübler).	$>\frac{1}{9}$ Yellow.	$<\frac{1}{9}$ Pink.	$>\frac{1}{9}$ Pink.	$>\frac{1}{9}$ Pink.	$\frac{1}{9}$	$>\frac{1}{9}$ Yellow.	$>\frac{1}{9}$ Orange pink.	$\frac{1}{9}$	All extracted. Yellow.
Safranin (B. S. S.).	0	0	$<\frac{1}{9}$ Pink.	$>\frac{1}{9}$	All extracted.	All extracted.	$>\frac{1}{9}$ Orange red.	$>\frac{1}{9}$ Orange red.	$>\frac{1}{9}$ Orange red.

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TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Croceïn scarlet 3 B (By.).	0	0	0	Pink.	Yellow pink.	Pink.	Orange.		
Azo-eosin (By.).	Pink.	Pink.	Orange.	Orange.			P Yellow pink.		Red orange.
Acid magenta (Bad.).	0	0	0	0	0	0	0	0	0
Eosin A (Bad.).									
Fast ponceau B (Bad.).	0	0	Nearly 0 Pink.				Orange red.		
Rose bengal (Bad.).	0						Orange red.		All extracted. Orange yellow
Cochineal red A (Bad.).	0	0	0	0	0	Orange red.	0	0	
Fast red A (Bad.).	0	Nearly 0 Yellow pink.	Nearly all extracted. Cherry red.	Nearly all extracted.	Nearly all extracted.	Nearly all extracted.	P		
Fast red B (Bad.).	0	0	Nearly 0 Pinkish.	Pink.	Nearly 0	Orange red.	P Orange red.		
Fast red C (Bad.).	0	0	Nearly 0 Pink.	Pink.	Nearly 0		Orange red.	Nearly 0	

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Fast red D (Bad.).	$<\frac{1}{4}$	$<\frac{1}{4}$	$>\frac{1}{2}$ Orange red.	$<\frac{1}{2}$	$\frac{1}{2}$	All extracted. Scarlet.	$P>\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Phloxin (Bad.).	$\frac{1}{4}$ Yellow fluor.	$\frac{1}{2}$	$>\frac{1}{2}$ Yellow.	$\frac{1}{2}$ Pink, no fluor.	$\frac{1}{2}$	$>\frac{1}{2}$ Yellow.	$\frac{1}{2}$ Orange fluor.	$\frac{1}{2}$	Nearly all extracted. Yellow.
Rhodamin (Bad.).	$<\frac{1}{4}$ Yellow fluor.	$<\frac{1}{2}$	$\frac{1}{2}$ Fluor.	All extracted. Orange fluor.	All extracted. Fluor.	All extracted. Fluor.	$>\frac{1}{2}$ Fluor.	$>\frac{1}{2}$ Fluor.	$>\frac{1}{2}$ Fluor.
Metanil yellow (Oehler).	$<\frac{1}{4}$	$<\frac{1}{2}$	$\frac{1}{2}$ Yellow.	$>\frac{1}{2}$	$\frac{1}{2}$	Nearly all extracted. Brown red.	Nearly all extracted. Yellow.	$>\frac{1}{2}$	$>\frac{1}{2}$
Chrysoïdin (Grübler).	$\frac{1}{2}$	All extracted.	$<\frac{1}{2}$	$\frac{1}{2}$	Nearly all extracted.	Nearly all extracted.	Nearly all extracted. Orange.	All extracted.	$>\frac{1}{2}$
Tropæolin OO (Cassella).	$<\frac{1}{2}$	$<\frac{1}{2}$	$\frac{1}{2}$ Yellow.	$>\frac{1}{2}$	$>\frac{1}{2}$	All extracted.	$>\frac{1}{2}$	Nearly all extracted.	$>\frac{1}{2}$
Lanafuchsin 6 B (Cassella).	0	0	0	Nearly 0	0	$\frac{1}{2}$	$\frac{1}{2}$	Nearly 0	$>\frac{1}{2}$
Brilliant cochineal 2 R (Cassella).	0	0	0 Yellowish.	Nearly 0	Nearly 0	$\frac{1}{2}$ Orange.	$\frac{1}{2}$ Orange.	$\frac{1}{2}$	$\frac{1}{2}$
Naphthol yellow or naphthylamin yellow (Grübler).	All extracted.	$\frac{1}{2}$	All extracted.	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	All extracted.	All extracted.	All extracted.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Fast pink B (Sch.).	Nearly all extracted. Colorless.	Nearly all extracted. Colorless.	½ Pink.	All extracted. Yellow fluor.	All extracted. Yellow fluor.	All extracted. Yellow fluor.	½ Yellow fluor.	½ Fluor.	½ Fluor.
Azo rubin (Sch.).	0	0	0	½	Nearly 0 H_2O solution, scarlet.	All extracted. Scarlet.	½ Pink orange.	Nearly 0	½
Ponceau 3 R (Sch.)	0	0	0	<½ H_2O solution, orange red.	0 H_2O solution, orange red.	½ Orange.	<½ Yellow pink; H_2O solution, orange red.	Nearly 0 Yellow pink.	<½ Orange.
Amaranth (Sch.)	0	0	0	0	0	Nearly 0	0	0	0
Brilliant pink (Sch.).	0	0	0	½	Nearly 0	>½ Orange red; H_2O solution, pink.	½ Red orange.	<½	½
Ponceau 2 R (Sch.).	0	0	0	Nearly 0	0	>½ Orange red; H_2O solution, pink.	Nearly 0 H_2O solution, orange.	Nearly 0 H_2O solution, orange.	½ Orange.
Pink M (R. H.)	>½ Nearly colorless.	>½ Colorless.	½	All extracted. Yellow fluor.	All extracted. Yellow fluor.	All extracted. Yellow fluor.	>½ Fluor.	½ Fluor.	>½ Fluor.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Scarlet RD (R. H.).	0	0	$<\frac{1}{2}$ Orange.	$\frac{1}{2}$	$\frac{1}{2}$ Orange.	Nearly all extracted. Orange.	$\frac{1}{2}$	$\frac{1}{2}$ Orange.	$\frac{1}{2}$
Archil substitute (R. H.).	0	Nearly 0 Pink.	Nearly 0 Violet ppt. in H_2O solution.	Nearly all extracted.	$>\frac{1}{2}$ Scarlet.	All extracted.	Nearly all extracted.	Nearly all extracted.	$>\frac{1}{2}$ Crimson.
Carmosin B (R. H.).	0	0	Nearly 0 Pink.	$\frac{1}{2}$	Nearly 0 Pink.	All extracted.	$\frac{1}{2}$	Nearly 0 Orange.	$\frac{1}{2}$ Scarlet.
Archil substitute 3 VN (St. Denis).	$<\frac{1}{2}$ Lilac; H_2O solution, crimson.	$<\frac{1}{2}$ Lilac; H_2O solution, crimson.	$\frac{1}{2}$ Red orange; H_2O solution, purple.	$>\frac{1}{2}$ Crimson.	$>\frac{1}{2}$ Magenta.	Nearly all extracted. Crimson.	$>\frac{1}{2}$	Nearly all extracted. Crimson.	$>\frac{1}{2}$ Crimson.
Biebrich fast scarlet O (Kalle).	0	0	Nearly 0	Nearly 0 Orange pink.	Nearly 0 Orange pink.	All extracted. Scarlet.	$<\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Biebrich croceïn scarlet O (Kalle).	0	0	0	Nearly 0 Pink.	Nearly 0 Pink.	All extracted. Scarlet.	$\frac{1}{2}$ Red orange.	$\frac{1}{2}$ Red orange.	$>\frac{1}{2}$ Red orange.
Biebrich brilliant croceïn scarlet O (Kalle).	0	0	0	$<\frac{1}{2}$ Orange pink.	$<\frac{1}{2}$	All extracted. Scarlet.	$\frac{1}{2}$	$\frac{1}{2}$	$>\frac{1}{2}$

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Acid green OO (Sch.).	0	0	0	0	0	>½ Blue green.	0	0	Nearly 0
Malachite green (Berlin).	Nearly 0	All color extracted. Colorless.	½ Greenish blue.	All extracted. Deep blue.	All extracted. Colorless.	All extracted.	Nearly all extracted. Deep blue.	All extracted. Colorless.	Nearly all extracted. Greenish blue.
Ethyl green (Berlin).	Nearly 0	All color extracted. Colorless.	All color extracted. Greenish blue.	All extracted. Deep blue.	All extracted. Colorless.	All extracted. Pale green blue.	All extracted. Deep blue.	All extracted. Colorless.	All extracted. Pale green blue.
Acid green 780 (Cassella).	0	0 H_2O solution, nearly colorless.	0 H_2O solution, pale green.	½ Blue.	0	½ Greenish blue.	0	0 H_2O solution, colorless.	0
Cyanole green 6G (Cassella).	0	0 H_2O solution, blue.	0 H_2O solution, yellow green.	>½ Deep blue; H_2O solution, pale green.	0 H_2O solution, deep blue.	½ Same as acetone.	>½	0 Colorless; H_2O solution, blue.	½ Blue; H_2O solution, yellow green.
Naphthol green B (Cassella).	0	0 H_2O solution, yellow green.	0 H_2O solution, green.	0	0	½ Brownish yellow; H_2O solution, yellow.	0	0	0
Methyl orange.	0	Nearly 0	0	<½	<½	½	½	½	½

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Naphthol yellow (Bad.).	0 H_2O solution, yellow.	0 H_2O solution, yellow.	0 H_2O solution, yellow.	Nearly 0	Nearly 0	$<\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$>\frac{1}{5}$
Tartrazin (Bad.).	0	0	0	0	0	$<\frac{1}{5}$	0	0	$\frac{1}{5}$
Fast yellow (Bad.).	0	0	0	Nearly 0	Nearly 0	Nearly 0	$\frac{1}{5}$	$\frac{1}{5}$	$<\frac{1}{5}$
Orange II (By.).	0	0	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	All extracted.	Nearly all extracted.	$>\frac{1}{5}$	$>\frac{1}{5}$
Croceïn orange G (By.).	0	0	$\frac{1}{5}$	$>\frac{1}{5}$	$\frac{1}{5}$	All extracted.	Nearly all extracted.	$\frac{1}{5}$	Nearly all extracted.
Ponceau 4 GB (Berlin).	0	0	$\frac{1}{5}$	All extracted.	Nearly all extracted.	All extracted.	Nearly all extracted.	Nearly all extracted.	All extracted.
Orange G (Berlin).	0	0	0	0	0	$\frac{1}{5}$	$\frac{1}{5}$	$<\frac{1}{5}$	$\frac{1}{5}$
Orange G (R. H.).	0	0	$\frac{1}{5}$	$>\frac{1}{5}$	$\frac{1}{5}$	All extracted.	$>\frac{1}{5}$	$>\frac{1}{5}$	$>\frac{1}{5}$
Orange extra (Cassella).	0	0	$\frac{1}{5}$	All extracted.	$\frac{1}{5}$	All extracted.	$>\frac{1}{5}$	$\frac{1}{5}$	$>\frac{1}{5}$
Orange GG crystals (Cassella).	0	0	0	0	0	$>\frac{1}{5}$	$<\frac{1}{5}$ Yellow.	$<\frac{1}{5}$ Yellow.	$\frac{1}{5}$

TABLE 11.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Tropæolin O (Cassella).	0	0	<⅛	<⅛ Yellow; H_2O solution, orange.	0	Nearly all extracted. Orange.	⅛	<⅛	>⅛
Brilliant yellow S (Sch.).	0	0	0 H_2O solution, orange.	0	0	0 H_2O solution, orange.	0	0	Nearly 0 Yellowish.
Wool yellow T (Sch.).	0	0	0	0	0	⅛ Yellow.	Nearly 0 Pale yellow.	0 H_2O solution, yellow.	<⅛ Yellow.
Crocein orange Y (Sch.).	0	0	⅛	All extracted.	>½	All extracted.	>½	⅛	>⅛
Orange IV (R. H.).	<⅛ Yellow.	⅛ Yellow; H_2O solution, orange.	⅛ Yellow; H_2O solution, crimson.	⅛	⅛	Nearly all extracted. Orange red; H_2O solution, pink.	Nearly all extracted.	Nearly all extracted. Orange.	Nearly all extracted. Red orange.
Tyemond orange (R. H.).	0	Nearly 0	<⅛ Yellow; H_2O solution, orange.	<⅛	<⅛ Yellow.	Nearly all extracted. Orange; H_2O solution, pink.	>½	>½	Nearly all extracted. Orange.
Yellow YM (R. H.).	0	0	⅛	<⅛	Nearly 0	⅛	⅛	⅛	>⅛
"Chinolin yellow" (R. H.).	Nearly 0	Nearly 0	⅛	⅛	⅛	>⅛	⅛	⅛	>⅛

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Orange 2 (St. Denis).	Nearly 0	Nearly 0	$\frac{1}{5}$	$\frac{1}{5}$	$<\frac{1}{2}$	All extracted. Orange.	$>\frac{1}{2}$	$\frac{1}{5}$	$>\frac{1}{2}$
Picric acid.	$<\frac{1}{5}$	0	$\frac{1}{5}$	$<\frac{1}{2}$	$\frac{1}{2}$	$>\frac{1}{2}$	Nearly all extracted.	$>\frac{1}{2}$	Nearly all extracted.
Azo blue (By.).	0	0	Dark blue precipitate. Solvent pink; H_2O solution, pink.	$\frac{1}{2}$ Crimson.	$<\frac{1}{2}$	Nearly all extracted. Magenta.	$\frac{1}{2}$	$<\frac{1}{2}$	Nearly all extracted. Crimson.
Methylene blue (Bad.).	0	0	0	$\frac{1}{2}$ Blue.	$\frac{1}{2}$	$\frac{1}{2}$	$>\frac{1}{2}$ Blue.	$>\frac{1}{2}$	$\frac{1}{2}$
Cyanole FF (Cassella).	0 H_2O solution, blue.	0 H_2O solution, blue.	0 H_2O solution, green.	$<\frac{1}{2}$ Blue.	0	$\frac{1}{2}$ Blue; H_2O solution, green.	$\frac{1}{2}$ Blue.	0	$\frac{1}{2}$ Blue; H_2O solution, green.
Tetracyanole SF (Cassella).	0	0	0	0	0	Very little extracted. Blue; H_2O solution, green.	$\frac{1}{2}$	Nearly 0	$<\frac{1}{2}$ Blue; H_2O solution, green yellow.
Methylene violet 2 BX (Berlin).	Nearly 0	$\frac{1}{2}$	$<\frac{1}{2}$ Violet; H_2O solution, blue.	$\frac{1}{2}$	All extracted. Violet.	All extracted. Violet.	Nearly all extracted. Violet.	All extracted. Violet.	$>\frac{1}{2}$ H_2O solution, blue.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

COAL TAR COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Methyl violet DB (Sch.).	Nearly 0	$\frac{1}{4}$	$<\frac{1}{4}$ Violet; H_2O solution, green.	Nearly all extracted.	All extracted. Violet.	$\frac{1}{4}$ H_2O solution, green.	Nearly all extracted.	$>\frac{1}{4}$	$\frac{1}{4}$ H_2O solution, blue.
Bismarck brown extra (Berlin).	$<\frac{1}{4}$ Orange.	Nearly all extracted. Brown orange.	0	$\frac{1}{4}$	Nearly all extracted. Brown orange.	$\frac{1}{4}$	$>\frac{1}{4}$	Nearly all extracted. Brown orange.	$\frac{1}{4}$
Fast brown G (Berlin).	0	0 H_2O solution, crimson.	$\frac{1}{4}$	All extracted.	$<\frac{1}{4}$ Crimson; H_2O solution, magenta.	All extracted. Magenta.	$>\frac{1}{4}$ Brown; H_2O solution, purple.	$\frac{1}{4}$	$>\frac{1}{4}$ Wine red.
NATURAL COLORS.									
Cochineal.	0	0	$\frac{1}{4}$ Orange.	Nearly 0	0	Nearly all extracted. Orange.	0	0	$>\frac{1}{4}$ Orange.
Carmin (Grübler).	0	0	$\frac{1}{4}$ Orange.	0	0	$\frac{1}{4}$ Red orange; H_2O solution, pink.	0	0	$>\frac{1}{4}$ Orange red.
Cudbear.	$\frac{1}{4}$ Wine red; H_2O solution, purple.	$<\frac{1}{4}$ Wine red; H_2O solution, purple.	$\frac{1}{4}$ Scarlet; H_2O solution, deep pink.	Nearly all extracted. Wine red.	$<\frac{1}{4}$ Purple.	Nearly all extracted. Wine red.	$>\frac{1}{4}$ Crimson.	$\frac{1}{4}$	$>\frac{1}{4}$ Crimson.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

NATURAL COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Archil.	$<\frac{1}{9}$ Red orange.	$<\frac{1}{9}$ Deep pink.	$\frac{1}{2}$ Orange red.	$\frac{1}{2}$ Scarlet; H_2O solution, magenta.	$<\frac{1}{2}$ Magenta; H_2O solution, purple.	$>\frac{1}{2}$ Wine red.	$\frac{1}{2}$ Scarlet.	$\frac{1}{2}$ Crimson.	Nearly all extracted. Wine red.
Litmus.	0	0	0	0	0	$\frac{1}{2}$ Pink.	0	0	Nearly all extracted. Deep yellow pink.
Azo litmin.	0	0	0	0	0	$<\frac{1}{2}$ Pink.	0	0	$>\frac{1}{2}$ Deep pink.
Catechu.	0	0	Nearly 0	0	0	Nearly 0	$\frac{1}{2}$	0	$<\frac{1}{2}$ Brown.
Logwood extract.	Nearly all extracted. Brown.	0	$<\frac{1}{9}$ Brown yellow.	All extracted. Brown.	Nearly 0 Pinkish; H_2O solution, deep brown.	$\frac{1}{2}$ Brown.	$>\frac{1}{2}$ Red orange; H_2O solution, magenta.	0 H_2O solution, purple.	$\frac{1}{2}$ Red brown.
Brazil-wood extract.	Nearly all extracted. Yellow.	Nearly 0 Colorless; H_2O solution, wine red.	$>\frac{1}{2}$ Orange yellow.	All extracted. Yellow.	Nearly 0. Pink; H_2O solution, wine red.	$>\frac{1}{2}$ Orange.	$\frac{1}{2}$ Orange; H_2O solution, pink.	0	Nearly all extracted. Orange.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

NATURAL COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Strawberry juice, fresh.	.....	0 H_2O solution, magenta.	Nearly 0	.....	<⅓ Colorless; H_2O solution, magenta.	⅓ Scarlet.	.....	⅓ Light brown; H_2O solution, dark-gray brown	⅓ Scarlet.
Blackberry juice, old.	.....	0 H_2O solution, blue.	0	.....	0 H_2O solution, blue gray.	0	.....	0 H_2O solution, gray blue.	Nearly 0 Pale pink.
Red raspberry juice, old.	.....	0 H_2O solution, deep blue.	0	.....	0 H_2O solution, deep blue.	0 H_2O solution, magenta.	.....	0 Yellow.	0 Orange.
Dark, sweet cherry juice, fresh.	.....	0 H_2O solution, dark purple.	0	.....	0 H_2O solution, green brown.	Nearly 0 Pink.	.....	0 H_2O solution, brown green.	<⅓ Orange red; H_2O solution, same.
Grape juice, Concord.	.....	0	0	.....	0 H_2O solution, brown green.	<⅓ Deep pink.	.....	0 H_2O solution, brown green.	⅓ Wine red.
Poke-berry extract.	0 H_2O solution, crimson.	0 Yellowish; H_2O solution, brown.	0	0	0 Yellowish; H_2O solution, brown.	<⅓ Purple.	Nearly 0 Pink.	0 Yellowish.. H_2O solution, brown green.	>⅓ Purple.
Saffron.	<⅓	<⅓	<⅓	⅓ Orange.	<⅓ Yellow.	⅓ Orange yellow.	<⅓ Yellow.	⅓ Yellow.	⅓

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

NATURAL COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color.		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Aloes.	$\frac{1}{3}$ Yellow.	$<\frac{1}{3}$ Orange; H_2O solution, red brown.	$<\frac{1}{3}$ Red orange; H_2O solution, brown red.	$>\frac{1}{3}$	$<\frac{1}{3}$ Red brown.	$<\frac{1}{3}$ Scarlet.	$>\frac{1}{3}$ Brown yellow.	Nearly 0 Yellow; H_2O solution, brown.	$\frac{1}{2}$ Brown yellow; H_2O solution, pale yellow.
Quercitron extract.	$>\frac{1}{3}$ Yellow.	Nearly 0 H_2O solution, brown.	Nearly all extracted. Yellow.	$>\frac{1}{3}$ Yellow; H_2O solution, light brown.	0 H_2O solution, brown.	$>\frac{1}{3}$ Brown yellow; H_2O solution, brown.	Nearly all extracted.	0	$>\frac{1}{3}$
Sumac extract.	$>\frac{1}{3}$ Pale yellow.	0	$\frac{1}{3}$	Nearly all extracted. Yellow.	0	Nearly all extracted. Yellow.	$>\frac{1}{3}$ Yellow.	0 H_2O solution, olive green.	$>\frac{1}{3}$ Yellow brown.
Annatto.	.....	$>\frac{1}{3}$ Orange.	Nearly all extracted. Orange.	.....	$>\frac{1}{3}$ Orange.	Nearly all extracted. Orange.	.....	$>\frac{1}{3}$ Orange.	All extracted.
Turmeric.	$>\frac{1}{3}$ Yellow.	All extracted. Yellow.	$>\frac{1}{2}$ Yellow.	$>\frac{1}{2}$ Yellow.	0	Nearly all extracted. Yellow.	All extracted. Yellow.	Nearly 0 Yellow.	All extracted. Yellow.
Persian berry extract.	$<\frac{1}{3}$ Yellow.	Nearly 0	$<\frac{1}{3}$	$<\frac{1}{3}$ Yellow; H_2O solution, yellow brown.	$<\frac{1}{3}$ Yellow.	$<\frac{1}{3}$ Yellowish.	$\frac{1}{3}$ Yellow; H_2O solution, yellow.	$<\frac{1}{3}$	$>\frac{1}{3}$ Yellow; H_2O solution, brownish.

TABLE II.—*Extraction of colors with immiscible solvents from aqueous solutions*—Continued.

NATURAL COLORS—Continued.

Name of color.	Ethyl acetate.			Amyl alcohol.			Acetone, from strong brine solution of color:		
	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.	Neutral.	Alkaline.	Acid.
Fustic extract.	$\frac{1}{4}$	Nearly 0	$<\frac{1}{4}$ Yellow.	Nearly 0	Nearly 0	Nearly all extracted. Yellow brown.	$>\frac{1}{4}$ Yellow brown.	$<\frac{1}{4}$ Yellow.	Nearly all extracted. Yellow brown.
Weld extract.	0	0	$<\frac{1}{4}$ Yellow.	$<\frac{1}{4}$ Yellow.	$<\frac{1}{4}$ Yellow.	$<\frac{1}{4}$ Nearly colorless.	$<\frac{1}{4}$ Yellow.	$<\frac{1}{4}$ Yellow.	$>\frac{1}{4}$ Brown yellow.
Tomato color.	$>\frac{1}{4}$ Orange.	$>\frac{1}{4}$ Orange.	$>\frac{1}{4}$ Orange.	All extracted. Orange yellow.	All extracted. Orange.	All extracted. Orange.	All extracted. Orange.	All extracted.	All extracted.
Spinach green.	$>\frac{1}{4}$ Green yellow.	Nearly all extracted. Yellow green.	Nearly all extracted. Yellow green.	$\frac{1}{4}$ Yellow green.	Nearly all extracted. Greenish yellow.	Nearly all extracted. Greenish yellow.	Nearly all extracted.	Nearly all extracted. Brown.	All extracted. Green brown.
Buckthorn berries.	$\frac{1}{4}$ Yellow.	$<\frac{1}{4}$ Yellow.	$>\frac{1}{4}$	$>\frac{1}{4}$ Yellow.	$<\frac{1}{4}$ Bright orange.	Nearly all extracted. Yellow.	All extracted. Yellow; H_2O solution, light brown.	0 H_2O solution, brown.	$>\frac{1}{4}$ Yellow.

TABLE III.—COLOR REACTIONS OF DYED FIBER (WOOL).

RED COLORS.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Ponceau 2 R (Sch.).	Rose red.	.....	Darker.	Red.	Orange.	.....	No change.	.....
Ponceau 3 R (Sch.).	Rose red.	Red.	Scarlet.	Red.	Orange.	.....	No change.	.....
Ponceau 6 R (M. L. B.).	Crimson.	Red.	Violet.	Violet.	Brown.	Brown.	No change.	Red.
Scarlet 6 R (M. L. B.).	Scarlet.	.....	Lilac.	.....	Orange brown.	.....	Darker.	Red.
Ponceau 4 RB (Berlin).	Dark blue.	Blue.	Dark blue.	Blue.	Dark crimson.	.....	No change.	Red.
Fast ponceau B (Bad.).	Dark blue.	Blue.	Deep green.	Green.	Brown violet.	.....	No change.	.....
Croceïn scarlet 3 B (By.).	Dark blue.	Blue.	Dark blue.	Blue.	Violet brown.	.....	No change.	Red.
Croceïn scarlet 7 B (By.).	Blue.	Blue.	Blue.	Blue.	Maroon.	.....	No change.	Red.
Biebrich croceïn scarlet O (Kalle).	Dark blue.	Blue.	Dark blue.	Blue.	Dark brown.	.....	No change.	Red.
Biebrich croceïn scarlet OO (Kalle).	Dark blue.	Blue.	Dark blue.	Blue.	Brown.	.....	No change.	Red.
Biebrich brilliant croceïn scarlet O (Kalle).	Dark blue.	Blue.	Purple.	Purple.	Dark brown.	.....	No change.	Red.

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

RED COLORS—Continued.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Biebrich fast scarlet O (Kalle).	Dark blue.	Blue.	Dark blue.	Blue.	Purple.	.....	No change.	.....
Scarlet RD (R. H.)	Crimson.	.....	Red.	Red.	Yellower.	.....	No change.	.....
Azo-rubin (Sch.).	Crimson.	.....	Violet.	Violet.	Red.	Red.	No change.	Red.
Amaranth (Sch.).	Darker.	.....	Violet.	Violet.	Partly decolorized.	.....	No change.	Red.
Amaranth B (Cassella).	Violet.	.....	Greenish blue.	Blue.	Dark violet.	.....	No change.	.....
Magenta.	Yellow brown.	Yellow.	Dirty violet.	Yellow.	Decolorized.	.....	Decolorized.	.....
Acid magenta (Bad. and Berlin).	Nearly or wholly decolorized.	.....	Yellow.	.....	Decolorized.	.....	Decolorized.	.....
Lanafuchsin 6 B (Cassella).	Rose red.	.....	Deep pink.	Red.	Deep pink.	.....	Nearly decolorized.	.....
Benzopurpurin.	Blue.	.....	Blue.	.....	No change.	.....	No change.	.....
Congo red.	Blue.	Colorless.	Blue.	Blue.	No change.	.....	No change.	.....
Fast red A (Bad.).	Purple.	Purple.	Violet.	Violet.	Deep orange brown.	Red.	No change.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

RED COLORS—Continued.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Fast red B (Bad.).	Purple.	.....	Dark blue.	Blue.	Light orange brown.	.....	No change.	.....
Fast red C (Bad.).	Crimson.	.....	Purple violet.	Violet.	Scarlet.	Red.	Redder.	Red.
Fast red D (Bad.).	Dark violet.	Violet.	Violet.	Violet.	Red brown.	Red.	No change.	.....
New coccin (Berlin).	Orange red.	Red.	Purple.	Purple.	Light brown.	Light brown.	No change.	Reddish.
Cochineal red A (Bad.).	Crimson.	Red.	Deep crimson.	Pink.	Yellow brown.	Yellow brown.	No change.	Red.
Brilliant cochineal 2 R (Cassella).	Darker.	.....	Crimson.	.....	Brownish yellow.	.....	No change.	Red.
Archil substitute (R. H.).	Light magenta.	Light magenta.	Darker.	.....	Darker.	.....	No change.	.....
Archil substitute 3 VN (St. Denis).	Magenta.	.....	Darker	.....	Darker.	.....	Lilac.	.....
Bordeaux B (Berlin).	Bluer.	Colorless.	Blue.	Blue.	Orange red.	Red.	No change.	Colorless.
Eosin.	Yellow.	.....	Yellow.	.....	Yellowish pink.	.....	No change.	.....
Eosin A (Bad.).	Yellow.	.....	Yellow.	.....	Darker.	Pink.	No change.	Pink.

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

RED COLORS—Continued.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Azo eosin (By.).	Crimson.	Crimson.	Crimson.	Crimson.	Orange.	Orange.	Orange red.	Orange.
Rose bengal (Bad.).	Yellowish.	.....	Orange.	.....	No change.	.....	No change.	Pink.
Phloxin (Bad.).	Yellow.	.....	Orange yellow.	Orange yellow.	No change.	.....	No change.	.....
Rhodamin (Bad.).	Orange.	Orange.	Yellow.	.....	No change.	.....	No change.	Pink.
Pink M (R. H.).	Pinkish yellow.	.....	Yellowish.	.....	Darker.	.....	No change.	.....
Fast pink B (Sch.).	Yellowish.	.....	Yellow.	.....	Bluer.	.....	No change.	Pink.
Carmosin B (R. H.).	No change.	.....	Purple.	.....	Yellower.	Pink.	No change.	Pink.
Safranin (B. S. S.).	Greenish blue.	Greenish blue.	Green.	.....	Crimson.	.....	Crimson.	.....
Cochineal.	No change.	.....	Brighter red.	.....	Magenta.	Magenta.	Crimson.	.....
Archil.	Deep pink.	.....	Bluish gray.	.....	Purple.	.....	Purple.	.....
Cudbear.	Deep pink.	.....	Dark gray.	.....	Violet.	.....	Violet.	.....
Logwood, chrome-mordanted cotton.	Red.	Red.	Brown.	.....	Black brown.	.....	Pale brown.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

RED COLORS—Continued.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Brazil wood, chrome-mordanted cotton.	Orange red.	Red.	Yellow brown.	.....	Maroon.	Maroon.	Purple.	Maroon.
Carthamin on cotton.	Orange.	.....	Brown.	.....	Yellow brown.	.....	Pinkish yellow.	.....
Barwood.	Yellow pink.	.....	Yellow brown.	.....	Maroon.	.....	Blue black.	.....
Poke berry.	Little change.	.....	Yellow brown.	.....	Yellow.	.....	Yellow.	.....

YELLOW AND ORANGE COLORS.

Metanil yellow (Ochler).	Magenta.	Magenta.	Dark violet.	Violet.	No change.	.....	No change.	Yellow.
Chrysoïdin.	Brown.	.....	Maroon.	Yellow.	No change.	.....	No change.	.....
Tropæolin OO (Cassella).	Magenta.	Magenta.	Deep violet.	Violet.	No change.	.....	No change.	.....
Methyl orange.	Scarlet.	Red.	Brown yellow.	.....	No change.	Colorless.	No change.	Orange yellow.
Naphthol yellow (Grübler).	Decolorized.	.....	Paler.	.....	No change.	Yellow.	No change.	Yellow.
Naphthol yellow (Bad.).	Decolorized.	.....	Paler.	.....	No change.	Yellow.	No change.	Yellow.
Tartrazin (Bad.).	Darker.	.....	Darker.	.....	No change.	Yellow.	No change.	Yellow.

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

YELLOW AND ORANGE COLORS—Continued.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Fast yellow (Bad.).	Red.	Orange red.	Orange.	.....	Darker.	.....	No change.	Yellow.
Tropæolin O (Cassella).	Orange.	Yellow.	Orange.	Yellow.	Orange red.	Orange.	No change.	Yellow.
Orange II (By.).	Scarlet.	Red.	Crimson.	.....	Red orange.	Orange.	No change.	.....
Orange II (St. Denis).	Crimson.	Crimson.	Crimson.	Crimson.	Orange red.	Red.	No change.	Orange.
Crocein orange G (By.).	Orange red.	.....	Orange.	.....	Darker.	.....	No change.	.....
Orange G (Berlin).	Darker.	.....	Orange.	.....	Terra cotta.	.....	No change.	.....
Orange G (R. H.).	Crimson.	.....	Crimson.	.....	Red orange.	.....	No change.	.....
Orange extra (Cassella).	Crimson.	.....	Crimson.	.....	Orange red.	.....	No change.	.....
Orange GG (Cassella).	Darker.	.....	Orange.	.....	Terra cotta.	.....	No change.	.....
Orange IV (R. H.).	Magenta.	Magenta.	Deep violet.	Violet.	No change.	.....	No change.	Yellow.
Crocein orange Y (Sch.).	Redder.	Red.	Darker.	Red.	Orange red.	Orange.	No change.	.....
Brilliant yellow S (Sch.).	Magenta.	Magenta.	Magenta.	Magenta.	Little darker.	Yellow.	No change.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

YELLOW AND ORANGE COLORS—Continued.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Wool yellow T (Sch.).	No change.	Yellow.	No change.	Yellow.	No change.	Yellow.	No change.	Yellow.
Tyemond orange Y (R. H.).	Violet.	.....	Magenta.	Red.	No change.	.....	No change.	.....
Yellow YM (R. H.).	Nearly decolorized.	.....	Paler.	.....	No change.	Yellow.	No change.	Yellow.
"Chinolin yellow" (R. H.).	Darker.	.....	Brownish yellow.	.....	Paler.	.....	No change.	.....
Ponceau 4 GB (Berlin).	Orange red.	.....	Orange.	.....	Little darker.	.....	No change.	.....
Picric acid.	Decolorized.	.....	Yellowish.	.....	Darker.	Yellow.	No change.	Yellow.
Spanish saffron.	Darker.	.....	Olive green, changing to maroon.	.....	No change.	.....	No change.	.....
Quercitron, alum-mordanted cotton.	No change.	Yellow.	No change.	.....	No change.	Yellow.	No change.	Yellow.
Sumac.	No change.	.....	Yellow brown.	.....	Brownish yellow.	.....	No change.	.....
Annatto.	Pale brown.	.....	Green.	.....	No change.	.....	No change.	.....
Turmeric.	Deep crimson.	.....	Orange brown.	.....	Orange.	.....	Orange.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

YELLOW AND ORANGE COLORS—Continued.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Persian berry (Coez).	Darker.	.....	Brownish yellow.	.....	Little darker.	.....	Darker.	.....
Fustic extract (Coez).	Orange yellow.	.....	Yellow brown.	.....	Orange yellow.	.....	Orange yellow.	.....
Weld, extract (Coez).	No change.	.....	Brownish yellow.	.....	Slightly deeper.	.....	Slightly deeper.	.....
Buckthorn.	No change.	.....	Brown yellow.	.....	No change.	.....	No change.	.....
Kamala.	No change.	.....	Darker.	.....	Brown orange.	.....	No change.	.....
Martins yellow.	Paler.	.....	Brownish yellow.	.....	Deeper.	Yellow.	Deeper.	Yellow.
Chrysamin.	Pale brown.	.....	Crimson.	Crimson.	Red orange.	Orange.	Darker.	.....

GREEN COLORS.

Malachite green (Berlin).	Decolorized.	Yellowish.	Decolorized.	Yellowish.	Decolorized.	.....	Decolorized.	.....
Ethyl green (Berlin).	Decolorized.	.....	Yellowish.	.....	Decolorized.	.....	Decolorized.	.....
Acid green (Cassella).	Yellow.	.....	Orange.	.....	Decolorized.	.....	Decolorized.	.....
Cyanole green 6 G (Cassella).	Orange.	.....	Yellowish.	.....	Darker.	.....	No change.	.....

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

GREEN COLORS—Continued.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Naphthol green B (Cassella).	Yellowish.	.....	Brownish yellow.	.....	No change.	.....	No change.	.....
Acid green OO (Sch.).	Yellow.	.....	Orange.	.....	Nearly decolorized.	.....	Nearly decolorized.	.....
Methyl green OO.	Yellow.	.....	Orange yellow.	.....	Decolorized.	.....	Decolorized.	.....

BLUE AND VIOLET COLORS.

Methylene violet 2 BX (Berlin).	Yellow.	.....	Yellow.	.....	Decolorized.	.....	Nearly decolorized.	.....
Methyl violet DB (Sch.).	Yellowish.	.....	Yellowish.	.....	Decolorized.	.....	Nearly decolorized.	.....
Guinea violet 4 B (Berlin).	Yellow.	.....	Orange yellow.	.....	Nearly decolorized.	.....	Paler.	.....
Methylene blue (Bad.).	Decolorized.	.....	Yellowish.	.....	Decolorized.	.....	No change.	.....
Azo blue (By.).	Darker.	.....	Greenish blue.	.....	Rose red.	.....	Purple.	.....
Cyanole FF (Cassella).	Yellow.	.....	Yellowish.	.....	Yellow green.	.....	No change.	Blue.
Tetracyanole SF (Cassella).	Yellow.	.....	Yellowish.	.....	Darker.	Blue.	Darker.	Blue.
Naphthol blue black (Cassella).	Darker.	.....	Darker.	.....	Darker.	Green blue.	No change.	Green blue.

TABLE III.—*Color reactions of dyed fiber (wool)*—Continued.

BLUE AND VIOLET COLORS—Continued.

Name of color.	Concentrated hydrochloric acid.		Concentrated sulphuric acid.		10 per cent caustic soda solution.		Ammonia 0.95.	
	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.	Fiber.	Solution.
Naphthol black BDF (Cassella).	Greenish blue.	.....	Olive green.	.....	Black.	.....	No change.	.....
Bismarck brown (Berlin).	Darker and redder.	.....	Browner.	.....	Yellower.	.....	Yellower.	.....
Fast brown G (Berlin).	Violet.	.....	Violet.	.....	Rose.	.....	Rose.	.....

TABLE IV.—APPEARANCE AND REACTIONS OF COLORS IN AQUEOUS SOLUTION AND WITH CONCENTRATED SULPHURIC ACID.

Name of color.	Color of aqueous solution as observed in ½" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Ponceau 2 R (Sch.).	Orange.	No change.	Brownish yellow.	No change.	Color not restored.	Cherry red.	Scarlet, then orange.
Ponceau 3 R (Sch.).	Red orange.	No change.	Brownish yellow.	No change.	Color not restored.	Cherry red.	Cherry red, then orange.
Ponceau 6 R (M. L. B.).	Pink.	No change.	Dirty yellow.	Paler.	Color not restored.	Purple.	Crimson, then scarlet.
Scarlet 6 R (M. L. B.).	Pink.	No change.	Dirty yellow.	Paler.	Color not restored.	Purple.	Crimson, then scarlet.
Ponceau 4 RB (Berlin).	Pink.	No change.	Paler and bluer.	No change.	Color not restored.	Dark blue.	Purple, then brown precipitate, then clear red solution.
Fast ponceau B (Bad.).	Red orange.	No change.	Purple.	No change.	Color not restored.	Dark bluish-green.	Blue, then maroon precipitate, then clear orange red solution.
Croceïn scarlet 3 B (By.).	Pink.	No change.	Purplish blue.	No change.	Color not restored.	Dark blue.	Blue, then purple, then red.
Croceïn scarlet 7 B (By.).	Pink.	No change.	Bluer.	No change.	Color not restored.	Dark blue.	Blue, then purple with brown precipitate, then clear red solution.
Biebrich croceïn scarlet O (Kalle).	Orange.	Slight excess HCl darker; large excess HCl lilac.	Magenta brown.	No change.	Color not restored.	Dark blue.	Blue, then violet, then orange-pink.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in ½" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Biebrich brilliant crocein scarlet O (Kalle).	Orange.	Slight excess HCl no change; large excess HCl gives lilac, then blue with brown precipitate.	Brown.	Orange brown.	Color not restored.	Magenta.	Violet blue, then pale magenta with brown precipitate.
Biebrich fast scarlet O (Kalle).	Cherry red.	Slight excess HCl no change; large excess HCl violet.	Crimson.	Crimson.	Color not restored.	Dark blue.	Blue, then brown, and finally orange.
Scarlet RD (R. H.).	Red orange.	No change.	No change.	No change.	Color not restored.	Crimson.	Crimson, then orange.
Azo rubin (Sch.).	Orange red.	Redder.	No change.	No change.	Color not restored.	Purple-violet.	Magenta, then crimson.
Amaranth (Sch.).	Light magenta.	Slightly bluer.	Slightly bluer.	No change.	Color not restored.	Purple-violet.	Magenta, then crimson.
Amaranth B (Cassella).	Crimson.	Bluer.	Purple.	Bluer.	Color not restored.	Dark blue.	Dark crimson.
Magenta.	Crimson.	Brownish yellow.	Color gradually fades away.	Color gradually fades away.	Color not restored.	Orange yellow.	Yellow.
Acid magenta (Bad. and Berlin).	Crimson.	Little darker.	Decolorized.	Decolorized.	Color not restored.	Orange yellow.	Magenta.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in ½" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Lanafuchsin 6 B (Cassella).	Magenta.	No change.	Pale yellowish pink.	Pale yellowish pink.	Color not restored.	Orange red.	Light crimson.
Benzopurpurin.	Orange red.	Dark blue and precipitate.	No change.	No change.	Color not restored.	Dark blue.	Blue precipitate.
Congo red.	Orange red.	Dark blue and precipitate.	No change.	No change.	Color not restored.	Dark blue.	Blue precipitate.
Fast red A (Bad.).	Orange red.	Brown yellow, red brown precipitate.	No change.	No change.	Color not restored.	Purple.	Purple, then yellow brown precipitate.
Fast red B (Bad.).	Magenta.	No change.	Pinkish yellow.	Yellowish pink.	Color not restored.	Dark blue.	Purple, then maroon precipitate, then clear magenta solution.
Fast red C (Bad.).	Orange red.	Redder.	No change.	No change.	Color not restored.	Violet.	Wine red solution and precipitate, then clear red solution.
Fast red D (Bad.).	Orange pink.	Brownish yellow.	Pink.	No change.	Color not restored.	Purple.	Brown red precipitate.
New coccin (Berlin).	Pink.	No change.	Dirty yellow.	Paler.	Color not restored.	Magenta.	Crimson, then orange red.
Cochineal red A (Bad.).	Yellowish pink.	No change.	Dirty yellow.	Paler.	Color not restored.	Magenta.	Magenta, then orange red.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in ½" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Brilliant cochineal 2 R (Cassella).	Orange red.	No change.	Brownish yellow.	No change.	Color not restored.	Orange red.	Red orange.
Archil substitute (R. H.).	Brown orange.	Red brown precipitate.	Red brown precipitate.	No change.	Color not restored.	Crimson.	No change.
Archil substitute 3 VN (St. Denis).	Orange pink.	Magenta.	Paler.	No change.	Color not restored.	Deep cherry red.	Magenta or crimson.
Bordeaux B (Berlin).	Magenta.	No change.	Red orange.	Paler.	Color not restored.	Dark blue.	Purple, then magenta.
Eosin.	Pink, fluorescent.	Yellow.	No change.	No change.	Color not restored.	Yellow.	Orange precipitate.
Eosin A (Bad.).	Yellowish-pink, fluorescent.	Yellow, not fluorescent.	No change.	No change.	Color not restored.	Yellow.	Orange precipitate.
Azo-eosin (By.).	Pink.	No change.	Brownish yellow.	Brownish yellow.	Color not restored.	Crimson.	Crimson, then brown-red precipitate, then clear pink solution.
Rose bengal (Bad.).	Pink.	Decolorized.	No change.	No change.	Color not restored.	Orange.	Orange precipitate, turning pink.
Phloxin (Bad.).	Pink, fluorescent.	Decolorized.	No change.	No change.	Color not restored.	Orange yellow.	Yellow, then colorless.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Rhodamin (Bad.).	Pale magenta, fluorescent.	Nearly decolorized.	No change.	No change.	Color not restored.	Yellow.	Orange red, then pink.
Pink M (R. H.).	Pale magenta, fluorescent.	Pink, less fluorescent.	No change.	No change.	Color restored.	Yellow.	Orange, then pink.
Fast pink B (Sch.).	Pale magenta, fluorescent.	Pale pink, not flourescent.	No change.	No change.	Color restored.	Yellow.	Orange, then pink.
Carmosin B (R. H.).	Orange red.	Magenta and stringy brown precipitate.	No change.	No change.	Color not restored.	Violet.	Magenta.
Safranin (B. S. S.).	Red.	Magenta.	No change.	No change.	Color restored.	Dark green.	Blue green, blue violet, and magenta.
Cochineal.	Orange red.	Orange yellow.	Magenta.	Magenta.	Zinc dust and HCl = orange yellow. Color not restored.	Pink.	Yellowish pink, then straw yellow.
Archil.	Deep lilac.	Yellowish pink.	Purple.	Purple.	Color restored.	Purple.	Red, red brown, and red orange.
Cudbear.	Lilac.	Yellowish pink.	Purple.	Purple.	Color restored.	Purple.	Red brown.
Logwood.	Brownish yellow.	Orange.	Dark brown.	Light brown.	Color not restored.	Yellow brown.	Paler.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in 1" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Brazil wood.	Red orange, slight fluorescence.	Orange, not fluorescent.	Crimson.	Crimson.	Color restored.	Brown yellow, flourescent.	Yellow, not fluorescent.
Barwood.	Insoluble.	Color precipitated on acidifying alkaline solution.	NaOH solution = deep brown red.	Ammonia solution = deep brown red.	NaOH solution + Zn dust = decolorized; on exposure = pinkish, then colorless.	Orange brown.	Pink.
Pokeberry.	Crimson.	Magenta.	Orange-yellow.	Magenta turning orange brown.	Color not restored.	Orange brown.	Brown.
Metanil yellow (Oehler).	Yellow.	Magenta.	No change.	No change.	Color not restored.	Purple.	Magenta.
Chrysoïdin.	Yellow.	Orange.	No change.	No change.	Color not restored.	Brownish yellow.	Red brown, orange brown, and orange.
Tropæolin O (Cassella).	Orange yellow.	No change.	Red orange.	Orange.	Color not restored.	Orange.	Orange.
Tropæolin OO (Cassella).	Yellow.	Magenta.	Little darker.	No change.	Color not restored.	Purple.	Magenta.
Methyl orange.	Orange.	Pink.	No change.	No change.	Color not restored.	Brownish red.	Orange red.
Naphthol yellow (Grübler).	Yellow.	Decolorized and cloudy.	No change.	No change.	Color not restored.	Orange yellow.	Yellow precipitate.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Naphthol yellow (Bad.).	Yellow.	Decolorized, clear solution.	No change.	No change.	Color not restored.	Yellow.	Yellow.
Tartrazin (Bad.).	Yellow.	No change.	No change.	No change.	Color not restored.	Yellow.	Yellow.
Fast yellow (Bad.).	Yellow.	Orange.	No change.	No change.	Color not restored.	Orange.	Orange red.
Orange II (By.).	Orange.	No change.	Orange red.	Orange red.	Color not restored.	Crimson.	Orange solution and brown precipitate.
Orange II (St Denis).	Orange.	Orange, stringy brown precipitate.	Orange red.	Red orange.	Color not restored.	Magenta.	Cherry red, then orange.
Crocein orange G (By.).	Orange.	No change.	Slightly redder.	Slightly redder.	Color not restored.	Brownish orange.	Orange red, then orange.
Orange G (Berlin).	Orange.	No change.	Pink.	No change.	Color not restored.	Orange.	Orange red, then orange.
Orange G (R. H.).	Orange.	No change.	Pink or orange red.	Red orange.	Color not restored.	Crimson.	Crimson, then orange, and a precipitate.
Orange extra (Cassella).	Orange.	No change.	Pink.	Redder.	Color not restored.	Crimson.	Crimson, then orange, flocculent red-brown precipitate.
Orange GG (Cassella).	Orange.	No change.	Pink.	No change.	Color not restored.	Orange yellow.	Orange, then orange yellow.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in 7" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Orange IV (R. H.).	Pale orange (not very soluble).	Magenta.	No change.	No change.	Color not restored.	Violet.	Magenta.
Crocein orange Y (Sch.).	Orange yellow.	No change.	Darker.	Darker.	Color not restored.	Orange.	Paler.
Brilliant yellow S (Sch.).	Yellow.	Darker; more HCl orange red; more HCl magenta.	No change.	No change.	Color not restored.	Crimson magenta.	Magenta, then orange red, orange and yellow.
Wool yellow T (Sch.).	Yellow.	No change.	No change.	No change.	Color not restored.	Yellow.	Yellow.
Tyemond orange Y (R. H.).	Orange.	Brown.	Yellow.	No change.	Color not restored.	Magenta.	Violet precipitate.
Yellow YM (R. H.).	Yellow.	Nearly decolorized.	No change.	No change.	Slowly turns red.	Yellow.	Yellow.
Quinolin yellow (R. H.).	Yellow.	No change.	No change.	No change.	Color not restored.	Orange.	Paler to yellow.
Ponceau 4 GB.	Orange.	No change.	Slightly redder.	Slightly redder.	Color not restored.	Orange.	Orange-red, then orange.
Picric acid.	Yellow.	Yellow and crystal precipitate.	Darker.	No change.	Color not restored.	Insoluble or colorless solution.	Yellow.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Spanish saffron.	Yellow.	No change.	Paler.	No change.	Color not restored.	Blue, then purple, maroon, and red-brown.	Yellow, then nearly colorless.
Quercitron.	Brownish-yellow.	Slightly redder.	Orange-brown.	Orange-brown.	Not decolorized.	Yellow.	Yellow.
Sumac.	Dirty yellow.	No change.	Greenish-brown.	Yellow-brown.	NaOH solution + Zn dust = decolorized; on exposure = pinkish, then colorless.	Yellow.	Yellow.
Annatto.	Yellow in alkaline solution.	Paler.	.....	.....	Zn + NaOH, not decolorized.	Blue.	Mauve.
Turmeric.	Yellow in alkaline solution.	Paler.	.....	.....	Zn + NaOH, not decolorized.	Orange.	Dirty yellow.
Persian berry.	Yellow.	No change.	Orange.	Deeper.	Not decolorized.	Yellow.	Yellow.
Fustic extract.	Yellow.	No change.	Brown-orange.	Orange.	Not decolorized.	Yellow.	Yellow.
Weld extract.	Yellow.	Paler.	Deeper.	Deeper.	Not decolorized.	Yellow.	Yellow.
Buckthorn.	Yellow.	No change.	Red-brown.	Yellow-brown.	Not decolorized.	Yellow.	Yellow.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in ¾" test tube.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Kaiuala.	Dilute alcohol solution of color— Yellow.	Paler and cloudy.	Yellow-brown.	Brownish-yellow.	NaOH solution of color = red; + zinc dust = orange. Original color not restored.	Orange.	Nearly colorless solution and orange precipitate.
Malachite-green (Berlin).	Blue.	Orange.	Decolorized.	Decolorized.	Color not restored.	Yellow.	Red-orange, then orange.
Ethyl green (Berlin).	Green.	Olive-green. Orange-yellow on adding little more HCl.	Decolorized by large excess.	Decolorized by large excess.	Color not restored.	Yellow.	Red-orange, then orange.
Acid green (Cassella).	Green.	Olive-green; more HCl = orange.	Decolorized by large excess.	Decolorized by large excess.	Color not restored.	Orange-yellow.	Red-orange, then orange.
Cyanole green 6 G (Cassella).	Blue-green.	Olive-green; more HCl = orange.	Dark blue.	Dark blue.	Color not restored.	Olive-green.	Orange.
Naphthol green B (Cassella).	Green.	Paler.	No change.	No change.	Color not restored.	Orange.	Yellow.
Acid green OO (Sch.).	Blue-green.	Yellowish-green to greenish-yellow.	Partly decolorized.	Partly decolorized.	Color not restored.	Orange-yellow.	Paler.
Methylene violet 2 BX (Berlin).	Violet.	Greenish-blue; more HCl = yellow-green.	Gradually turns pink.	Gradually grows paler.	Color not restored.	Yellow-orange.	Yellow; copious dilution = pale green and then blue.

TABLE IV.—*Appearance and reactions of colors in aqueous solution and with concentrated sulphuric acid*—Continued.

Name of color.	Color of aqueous solution as observed in ¾" test tubes.	Add to aqueous solution of color—				Dry color + concentrated sulphuric acid.	
		Hydrochloric acid, 1.10. (5–10 drops.)	10 per cent sodium hydrate solution. (5–10 drops.)	Ammonia, 0.95. (5–10 drops.)	Zinc dust + HCl, and expose to air on filter paper.	Before dilution.	After dilution.
Methyl violet DB (Sch.).	Violet.	Yellow.	Magenta.	No change.	Color not restored.	Yellow-orange.	Brown-orange, then green, then blue.
Guinea violet 4 B (Berlin).	Violet.	Blue, then green.	Gradually paler and bluer.	Gradually paler and bluer.	Color not restored.	Orange.	Orange-yellow, greenish-yellow, pale green, and pale blue.
Methylene blue (Bad.).	Blue.	No change.	No change.	No change.	Color restored.	Dark green.	Blue.
Azo blue (By.).	Purple.	Dark precipitate; purple solution.	Pale magenta.	In large excess gradually turns pale magenta.	Color not restored.	Deep blue.	Violet precipitate.
Cyanole FF (Cassella).	Purplish-blue.	Greenish-yellow.	Bluish-green by transmitted light; pink by reflected.	No change.	Color not restored.	Yellow.	Orange-yellow.
Tetracyanole SF (Cassella).	Blue.	Yellow.	No change.	No change.	Color not restored.	Yellow.	Orange.
Naphthol blue-black (Cassella).	Deep blue.	Blue solution and precipitate.	No change.	No change.	Color restored.	Dark green.	Blue-green, then blue.
Naphthol black BDF (Cassella).	Deep magenta.	Blue.	Purplish-blue.	Darker.	Color not restored.	Greenish-black.	Green, then blue.
Bismarck brown (Berlin).	Yellow.	Orange.	No change.	No change.	Color restored.	Brown.	Brownish-red, then orange.
Fast brown G (Berlin).	Brownish-red.	Paler solution and violet precipitate.	Magenta.	Magenta.	Color not restored.	Violet-blue.	Magenta.